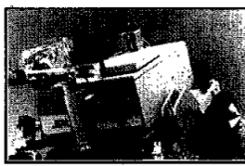




### Advanced suit

Testing has been completed on a shuttle Advanced Crew Escape Suit, and subjects are pleased with results. Story on Page 3.



### Mini-rover testing

Rocky III, a mini-rover that could provide a low cost approach to exploring Mars, passed tests with flying colors. Story on Page 4.

# Space News Roundup

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No. 41

## Atlantis moves to VAB as work continues

By James Hartsfield

*Atlantis* is to be on the move today as it is transferred from the hangar it has occupied for three months to KSC's Vehicle Assembly Building where the spacecraft will be pointed skyward and attached to the fuel tank and solid rockets for STS-44.

*Atlantis* is scheduled to travel to the launch pad in about one week, with preparations to launch STS-44 in November beginning in earnest. A flight readiness review, the final check of all preparations for the mission, will take place in early November and culminate with the scheduling of an official launch date.

*Atlantis'* next flight will be a 10 day mission to deploy Defense Support Program Satellite and its Inertial Upper Stage booster. DSP is

a survivable and reliable satellite-borne system that detects and reports on real-time missile launches, space launches and nuclear detonations.

Crew members are Commander Fred Gregory, Pilot Terrence Henricks, mission specialists James Voss, Story Musgrave and Mario Runco Jr., and payload specialist Tom Hennen.

This week, technicians closed *Atlantis'* payload bay, made a final test of the landing gear, checked the tires and finished work on the wings' front edges. A final step prior to moving the orbiter, weighing of the spacecraft and calculating its center of gravity, was

scheduled for Thursday.

On *Discovery*, currently in Orbiter Processing Facility 3, work this week began to reinstall the heat protection panels on the front of the wings. A check of 42 seals that act as expansion joints for those panels found only one with a slight crack. The cracked seal will be replaced as the reinstallation work progresses.

Other work on *Discovery* this week included checks of the mechanical arm and touching up of heat protection tiles around the nose landing gear.

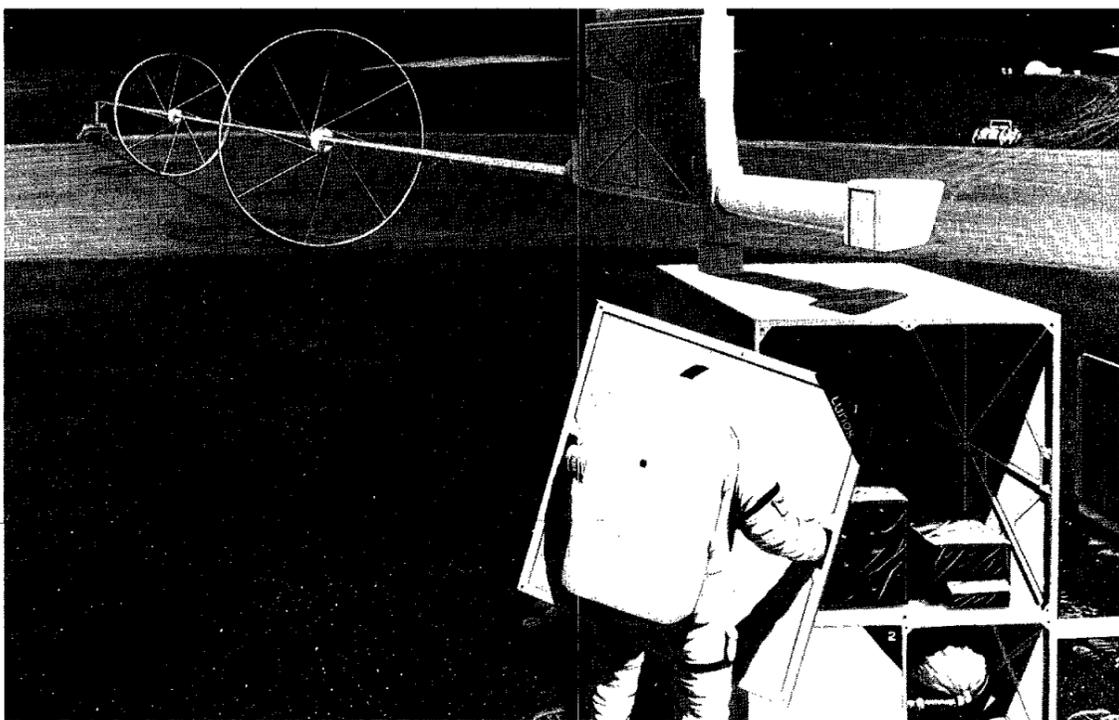
*Discovery* will next fly in January with the International Microgravity Laboratory mission.

*Endeavour*, in the Bay 1 processing hangar, continues to go through extensive tests and preparations for its maiden flight in the spring of 1992. The orbital maneuvering system pods, one each located left and right of the spacecraft's tail, are to be installed early next week. This week, checks were performed on the hydraulic system and aerodynamic operations, movements of the rudder, elevons and ailerons.

Heat protection blankets also are being installed on *Endeavour* and inspections are under way of the wing struts. The inertial measurement units, three platforms that tell the spacecraft its location, direction, speed and orientation in space, were installed as well.



ATLANTIS



NASA Illustration

Lunar oxygen production plants, such as the one depicted in this artist's conception, could be the descendants of prototype systems being tested and evaluated now.

## Researchers demonstrate methods to create resources from lunar soil

By Billie Deason

Water condensed from materials found on the Moon flowed through a demonstration unit set up for the first In-Situ Resource Utilization seminar last week at JSC.

ISRU refers to the concept of using local resources of the Moon or Mars to make products such as propellants, life support consumables and building materials.

"Water itself is not present on the Moon, but the components of water, hydrogen and oxygen, are contained in the Lunar soil," said Lawrence

Taylor, who presented an evaluation of eight candidate processes for recovering water on the Lunar surface.

Taylor is principal investigator for a study funded by a JSC grant to the University of Tennessee to research oxygen production processes and development of an oxygen production prototype unit.

"Lunar soil contains a small amount of hydrogen which has been implanted into the soil as solar-wind particles," Taylor said.

"We can easily recover the hydrogen by roasting the soil at tempera-

tures of 500 to 700 degrees Celsius. Oxygen is plentiful but is bound up in the rocks, minerals, and glasses of the Moon. It is more difficult to liberate the oxygen from these materials."

Scientists and engineers in JSC's Solar System Exploration Division and the Lunar and Mars Exploration Program Office are working on the support systems that would be needed for a manned Lunar base.

"If we can develop an efficient method to recover oxygen and make water from materials already present

Please see **MOON**, Page 4

## Q+ Teams bring TQM to front lines

By Brian Welch

It was 1955, and the engineers at Japan's Nissan Corporation expected the professorial retiree from the Willys-Overland Company to lecture them on all of the American secrets to automotive success. He disappointed them at first.

His name was Donald Stone and, according to David Halberstam, who relates the story in his 1986 best seller "The Reckoning," he was reserved and tweedy, just about what they expected, except that he showed little enthusiasm for the long classroom lectures on engines which he had been hired to deliver.

Instead, Stone would trudge through the lectures, obviously not inspired, but after class, with what the Japanese regarded as typical American pragmatism, he would gather the Nissan engineers around him and ask about their problems out on the factory floors. If a crankshaft was giving one engineer fits, they would all journey to its source in Yokohama and Stone would lead the discussion as they chipped away at the problem.

"He was teaching them," Halberstam writes, "that engineering advanced by small degrees, always based upon performance. He repeated to them again and again his basic approach: Find out what was wrong, try to understand why it had gone wrong, and then break down the corrective process into modest steps."

And it worked. Over time, Nissan honed such techniques for achieving quality and managing their processes. By 1958, the same year NASA was being formed to meet the challenges of space flight, the Japanese were

ready to face the challenges of the American automotive marketplace.

Now the same techniques which helped transform Japan into an economic superpower are being employed here in the business of space flight, and by the end of this year the people of JSC will have ample opportunity to watch the process unfold. In a phrase, it's known as Total Quality Management, or TQM.

Already, three levels of training have been completed in the Administration, Mission Operations, Engineering and Safety, Reliability and Quality Assurance directorates, with at least one level of training complete in most other organizations. The first two levels of training consist of workshops for managers, from the Senior Staff level to branch chiefs and section heads. The third level of training is the culmination of the entire process, however, because it entails the creation of employee teams across the length and breadth of the entire center, one member for every 40 or so employees. Their job will be to continuously look for ways to improve how the work is done.

These employee groups are known as Quality Plus Teams, or, in the soon to be familiar shorthand, Q+.

"Embedded in the philosophy of the entire process," said Associate Director Dan Nebrigg, who serves as chairman of JSC's TQM Steering Committee, "is the idea that nobody knows how to improve our work better than those who are on the front line, actually doing it."

Dr. Donald Robbins, Deputy Director of Space and Life Sciences, echoes that sentiment.

Please see **TOTAL**, Page 4

## NASA tests windshear warning system

Results from a NASA flight test program show that new sensor technology may provide airline flight crews with advance warning of "microbursts" that sometimes harbor potentially dangerous windshears.

A microburst is an intense downdraft that produces strong divergent winds near the ground, typically for a short duration and over a relatively small area. When an airliner is taking off or landing, a microburst can force the plane into the ground before the flight crew can take proper corrective action.

NASA's Boeing 737 Transport Systems Research Vehicle is equipped with a number of instruments intended to detect hazardous windshear in time for the aircraft to avoid it. NASA and the Federal Aviation Administration are most interested in sensors that will provide

a minimum of 20-40 seconds advance warning of microburst windshear conditions.

Although airlines are in the process of equipping their planes with windshear detection systems, these commercial systems are designed to alert the flight crew that the aircraft is experiencing hazardous windshear. The FAA has mandated that airlines must select and install an approved microburst detection system on their aircraft by the end of 1995.

The NASA 737 flight tests represent the final phase of a joint NASA/FAA windshear research program started in 1986. The FAA determines the requirements for the program, while NASA is developing the technology for airborne sensors.

Researchers believe the combination of ground-based and airborne

detection will give commercial airline pilots time to avoid or escape a microburst.

The only way to ensure that these advanced instruments operate reliably is for test aircraft to fly into a variety of shears and compare the instruments' performance with what the plane actually encounters.

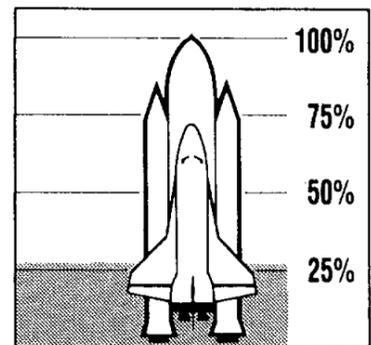
NASA recently completed a flight test program in Orlando and Denver which was highly successful.

Both airports have experimental ground-based Doppler radars designed to spot windshear. Information from these radar systems was used in the studies to direct the aircraft toward microbursts. For safety, the aircraft flew 750 to 1,100 feet above the ground at 210 knots (about 240 statute mph).

The research aircraft carried the

forward-looking remote sensors, one based on radar technology and one based on infrared technology. The radar sensor, a modified aircraft weather radar, detects sudden, large changes in raindrop velocities in a storm cell ahead of the airplane. NASA modifications to the otherwise off-the-shelf radar filter out false indicators like cars moving in opposite directions near the airport, allowing windshear readings near ground level. The infrared sensor is a passive instrument that measures temperature changes usually produced by microbursts.

The flight tests also demonstrated a Langley-developed data link between ground weather radar and the 737 and the feasibility of deriving a windshear alert from that data and displaying it in the aircraft.



1991 GOAL: \$385,000



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## Ticket Window

The following discount tickets are available for purchase in the Bldg. 11 Exchange Gift Store from 10 a.m.-2 p.m. weekdays.

General Cinema (valid for one year): \$4.  
 AMC Theater (valid until May 1992): \$3.75.  
 Loews Theater (valid for one year): \$4.  
 Texas Renaissance Festival (9 a.m.-6 p.m. weekdays Oct. 5-Nov. 17, Plantersville): child (5-12), \$5.55; adult, \$9.25.  
 Renaissance Festival bus trip (7:30 a.m.-5:30 p.m. Oct. 26 or Nov. 9, includes transportation and admission): child, under 5, \$7; child, 5-12 years, \$10; adult, \$15.  
 NASA Night at Delta Downs (Nov. 16-17). Day trip (3:30 p.m.-2:30 a.m., includes transportation and admission to clubhouse): \$15. Overnight trip (12:30 p.m.-12:30 p.m., includes transportation, reception at Beaumont Hilton, accommodations, admission, brunch): \$50.  
 Halloween Dance (7 p.m. Oct. 26, Gilruth Center, music by 4th Wave Rhythm, costumes encouraged, prizes best costumes): \$15.  
 Wings Over Houston Air Show (8 a.m.-6 p.m. Oct. 26-27, Ellington Field): child (6-11), \$2; adult, \$7.  
 Mulligan Golf Tournament (Oct. 23-24, TPC Golf Course, the Woodlands): \$14; (Oct. 25-26): \$19; season gallery badge, \$54.  
 Entertainment '92 (coupon book): \$26 for FBA members' first book; \$27 for all others.

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## Gilruth Center News

**Sign up policy** — All classes and athletic activities are first come, first served. Sign up in person at the Gilruth Center and show a badge or EAA membership card. Classes tend to fill up four weeks in advance. For more information, call x30304.

**Defensive driving** — Course is offered from 8 a.m.-5 p.m. Dec. 14. Cost is \$15.

**Aerobic dance** — High/low-impact classes meet from 5:15-6:15 p.m. Tuesdays and Thursdays. Cost is \$32.

**Exercise** — Low-impact class meets from 5:15-6:15 p.m. Mondays and Wednesdays. Cost is \$24.

**Weight safety** — Required course for employees wishing to use the Gilruth weight room. The next class will be from 8-9:30 p.m. Oct. 17, Nov. 7 and Nov. 21. Cost is \$5; preregistration required.

**Aikido** — Martial arts class meets Tuesdays 6:30-7:30 p.m. and Fridays 5:15-6:15 p.m. Cost is \$35 per month.

**Country and western dance** — Six-week course meets Mondays 7-10 p.m. beginning Nov. 4. Cost is \$20.

**Intercenter run** — Runners may turn in two-mile and 10-kilometer run times for competition among NASA centers throughout October. Participants must register at the Gilruth.

**Fitness program** — Health Related Fitness Program includes medical examination screening, 12-week individually prescribed education program. Call Larry Wier, x30301.

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## Dates & Data

### Today

**Cafeteria menu** — Special: Salisbury steak. Entrees: baked scrod, broiled chicken with peach half. Soup: seafood gumbo. Vegetables: cauliflower au gratin, mixed vegetables, buttered cabbage, whipped potatoes.

### Saturday

**MOD open house** — The Mission Operations Directorate will host an open house for MOD employees and their families from noon-6 p.m. Oct. 19. An art contest for children will be held at the Gilruth Center at 4:30 p.m. For more information, call Steven Gonzalez, x37006.

**Star Party** — A public Star Party sponsored by the JSC Astronomical Society will be Oct. 19 at Challenger 7 Park on FM 528. Observing begins at dusk and continues through 10:30 p.m. For more information, call Bill Williams, 339-1367.

### Monday

**Cafeteria menu** — Special: beef and macaroni. Entrees: ham steak, Parmesan steak. Soup: chicken and rice. Vegetables: green beans, carrots, au gratin potatoes.

### Tuesday

**Free enterprise lecture** — A brown-bag luncheon will ask "Are We Falling Behind the Japanese?" at 11:30 a.m. Oct. 22 in the Lockheed Plaza eighth floor Training Room. Call Charles Campbell at 333-6107 for more information.

**Cafeteria menu** — Special: Mexican dinner. Entrees: potato baked chicken, barbecue spare ribs. Soup: tomato. Vegetables: squash, ranch beans, Spanish rice, broccoli.

### Wednesday

**NMA meets** — The JSC chapter of the National Management Association will meet at 5 p.m. Oct. 23 in the Gilruth Center. Citizens Against Crime will present a personal security management program. For more information, call Valerie Burnham, x34210.

**AFCEA meets** — The Armed Forces Communications and Electronics Association will meet at 11:30 a.m. Oct. 23 at the Lakewood Yacht Club on NASA Road 1. Dave Lindsay and Jackie Wilson, both of Lyondell Petrochemical Co., will speak on "How to Win the Malcolm Baldrige Award." Reservations deadline is noon Oct. 21; cost is \$12 for members, \$14 for nonmembers. For more information, call Veronica Mullins, 283-7342.

**BANN meets** — The Bay Area NAFE Network will meet at 11:30 a.m. Oct. 23 at the South Shore Harbour Country Club. Dr. John Schoonmaker will discuss "Right Brain vs. Left Brain Thinking." Reservations deadline is noon today; cost is \$3 for members, \$5 for nonmembers, add \$7 for luncheon. For more information, call Sharon Westerman at 486-8927.

**Cafeteria menu** — Special: baked meatloaf with Creole sauce. Entrees: baked scrod, liver and onions, ham steak. Soup: seafood gumbo. Vegetables: beets, Brussels sprouts, green beans, whipped potatoes.

### Thursday

**AIAA meets** — The American Institute of Aeronautics and Astronautics will meet at 5:30 p.m. Oct. 24 at the Gilruth Center. Dr. Michael Duke, deputy for science in JSC's Lunar and Mars Exploration Program Office, will

speaking. Dinner cost is \$9 for members, \$10 for nonmembers and \$8 for students; reservations deadline is noon Oct. 21. For reservations, call 333-6064, 283-4214, 283-6000 or 282-3160.

**SOLE meets** — The Houston Chapter of the Society of Logistics Engineers will present a briefing on the Houston papers for the ninth Space Logistics Symposium at 5:30 p.m. Oct. 24 at the South Shore Harbour Country Club. For reservations, call Dennis Wise, x3661, or Lee Graham, x30913.

**Cafeteria menu** — Special: smothered steak with dressing. Entrees: chicken and dumplings, corned beef with cabbage. Soup: beef and barley. Vegetables: spinach, cabbage, cauliflower au gratin, parsley potatoes.

### Oct. 25

**Cafeteria menu** — Special: tuna and salmon croquette. Entrees: pork chop with yam rosette, Creole baked cod. Soup: seafood gumbo. Vegetables: Brussels sprouts, green beans, buttered corn, whipped potatoes.

### Oct. 27

**JSC Bike Club** — The Lions Eye Bank of Texas and the JSC Bicycle Club are hosting the 13th Annual Texas Coastal Century at 8 a.m. Oct. 27 at the University of Houston-Clear Lake. Registration fees are \$15 before Oct. 1 and \$20 late/on-site registration fee. The distance will be 25 miles, 34 miles, 62 miles, and 100 miles. All proceeds will benefit the Lions Eye Bank of Texas and its Sight Restoration Programs. For more information contact Tom Moore, 798-5509, or Mike Prendergast, 480-3330.

## Swap Shop

Swap Shop ads are accepted from current and retired NASA civil service employees and on-site contractor employees. Each ad must be submitted on a separate full-sized, revised JSC Form 1452. Deadline is 5 p.m. every Friday, two weeks before the desired date of publication. Ads may be run only once. Send ads to Roundup Swap Shop, Code AP3, or deliver them to the deposit box outside Rm. 147 in Bldg. 2. No phone or fax ads accepted.

### Property

Rent: Baywind II condo, 1-1, W/D, refrig w/ice maker, microwave, new paint/carpet, D/W, near pool, \$440/mo. Steve, 244-7474 or 486-8047.

Sale: CL townhouse, 3-2-2, loft, decked patio, 1500 sq ft, custom extras, \$92K OBO. Dennis, x31733.

Rent: Lake Travis cabin, priv boat dock, CA/H, fully equipped, accom 8, wkly/daily, \$325/\$80. 474-4922.

Sale: La Porte, 2 story, 3-2.5-1, lg corner lot, assume \$506/mo for \$10K equity. 474-2660.

Sale: Friendswood lot, 0.95 acre, all utilities, cul-de-sac, \$45K. Ron, 996-9724.

Sale: La Marque, 3-1-1, appliances, ceiling fans, deck, storage bldg, \$41K OBO. (409) 935-1837.

Sale: Medical Ctr condo, 2-1-1, FPL, alarm, W/D, refrig w/ice maker, microwave, poolside, assume FHA loan, \$314.18/mo. Janet Case, 480-5151.

Sale: Friendswood, 3-2-2, brick, new vinyl trim, parquet entry, 2 living areas, lg master, lg wood deck, \$66.7K. 482-6651.

Lease: 3-2-2, remodeled, \$595/mo. Minh, 333-6806 or Oanh, 484-2456.

Sale: '80 Fleetwood MH w/attached room, 3-2, 1400 sq ft, garden kitchen w/bay window, wet bar, ex cond, to be moved, \$10K. 331-7565.

Lease: Pipers Meadow, 3-2-2, FPL, fans, W/D conn, \$795. x31826 or 480-9436.

Sale: Pearland lot, Dixie Hollow subdivision, concrete street, all utilities. x39530 or 482-5003.

Rent: Galveston condo, furnished, sleeps six, Seawall Blvd & 61st St, cable TV, swimming pools, wkend/wkly/daily. Magdi Yassa, 333-4760 or 486-0788.

### Cars and Trucks

'86 Custom Ford van, blue/gray, ex cond, 20K mi, new tires, \$8.9K. 534-4607.

'85 Nissan Pulsar, 2 dr, sun roof, ex cond, \$2750. 286-4253.

'76 Datsun 280Z, auto, A/C, cruise, needs work, BO. Deb, 486-2609.

'69 Chevelle, auto, A/C, V8, 4 dr, 53K mi,

inspection thru 9/92, \$540. Jerry, 283-5495 or 774-4122.

'74 BMW 2002, 4 spd, green w/tan int, new tires, new \$2K paint job, sun roof, AM/FM/cass, ex cond, \$8K OBO. David, x32791 or 488-9768.

'84 Porsche 944, burg, 5 spd, sunroof, new AM/FM/CD player, 75K mi, \$5K. Stan, 282-2761 or 486-7708.

'91 RS Camero, 19K mi, \$12.6K. Gloria, 280-5967 or 554-5201.

'89 Mazda 626 LX, loaded, 21K mi, ex cond, \$11.5K. x37653 or 488-4989.

'84 Colt Vista station wagon, maroon w/gray int, auto, A/C, good cond, \$2.3K. 486-5247.

'85 Chevy Cavalier, 4 dr, 4 cyl/2.0L, auto, 72K mi, new tires/brakes, ex cond, \$2.7K. 488-5522.

'87 Toyota Celica ST, A/C, AM/FM, 61K mi, good cond, \$5.5K. x39150.

'85 Bronco II, 4x4, 5 spd, P/S, P/B, cruise, sunroof, ex cond, \$5950. 532-1673.

'83 S-10 Blazer, V6, 4 WD, 5 spd, good cond, \$3.5K OBO. James, 335-6834 or 332-7074.

'83 Monte Carlo, \$2.5K OBO. 482-6744.

'69 Buick Skylark, 4 dr, 350 V8, \$1.2K. 649-5092.

'74 Chrysler Newport, new battery, exc tires, good cond, 117K mi, have repair file, \$1K. Ray, 333-7519 or 554-6252.

'89 Pontiac Trans Am GTA, flame red w/gray leather int, T-top, loaded, 45K mi, \$14.5K OBO. 676-3851 or 488-2258.

'88 Mustang GT, blue/silv, tinted windows, 5 spd, garaged, records, good cond, 50K mi, \$7.9K OBO. x36464 or 488-2258.

**Cycles**

'83 Yamaha IT 250, new Dunlops, air filter, brake pads, chain, ex cond, \$695; '79 Yamaha DT 250 Enduro, good cond, \$275; '90 Kawasaki, Tengai, 650 KLR, Paris to Dakaar special, dual purpose, elec start, ex cond, \$3250. Dan, 280-2780 or 457-2850.

Mens 20' League Fuji racing bike, 12 spd, pump, water bottle, extra tube, owners manual, ex cond, \$175. Maureen, x38799 or 333-4845.

**Boats and Planes**

12 ft Mod V Hull, O/B, trolling mtr, \$600. Bill, x36526 or 481-4612.

'82 Mako, 21', ctr console, 200hp Evinrude w/91 Powerhead, Loran, depth etc sportsman trlr, garaged, ex cond, \$9.7K. Dan, (409) 925-7791.

22' Chrysler sailboat, recent bottom job, good main, 2 Jibs, 15hp, tandem axle trlr, plus access. good cond, \$4.1K. Walt, x35939.

Windsurfing equipment, '90 F2 Bullitt short board, Powerex carbon masts, Weichart alum masts, other items. 486-5734.

### Audiovisual & Computers

19" RCA Color-Trak TV, \$150 OBO. 474-3408.

PC-XT clone, 512 RAM, 2 FD, Taxan, RGB color moni, SW, \$200. Marc, 332-8961.

New NEC Powermate PC, 5x20/44 MB HD, VGA moni, 256K VGA card, 386 IBM clone, plus windows SW, \$1.6K. x30643 or 488-4373.

25" Emerson stereo color TV w/remote, works great, color is little off, \$100 OBO. Dave, x33537.

Macintosh extended kybd, Keytronic MacPro 105 key ADB kybd, new in box, \$50. 286-2213.

Infinity Quantum Jr speakers, 12" 3 way, \$200 OBO; Recoton MTS TV stereo decoder, \$25; DBX 3BX III Dynamic range expander, \$100; Nikko Eq 1, 12 band equalizer, \$50. Jim, 286-1766.

Apple IIc, 12" moni, ext dr, mouse with S/W, 300-1200 modem, \$595 OBO. 538-1479.

Commodore 64, Brother printer, DD, modem, SW, \$450 OBO. 488-7180.

19" Wards color TV, contemporary cabinet, works well, \$300 OBO. 554-2320.

Star Micronics Daisy Wheel printer, wide carriage, w/dust cover, manual, was \$450, now, \$100; assorted 16 Daisy Wheels, \$32, all ex cond. Ben, 335-2141.

HP Deskjet 500 printer, ex cond, \$390; Amiga 500 computer sys, A1080 color moni, ext FD, 3MB memory, MIDI interface, S/W, \$900. Joe, x33559 or 996-1667.

**Musical Instruments**

Yamaha ME-10, stand-up keyboard w/stool, speaker, amp, instructions, ex cond, \$700. Bob, x38615 or Jean, 559-2325.

**Pets & Livestock**

Cockapoo puppies, solid blk, avail Oct 17, \$75 females, \$50 males. 996-0981.

Baby cockatiels, hand fed. Linda, 484-7834.

Free red/whit kitten. x39082 or 488-5077.

Free spayed female cat, 1 yr old, current vaccinations. Sharon, 481-1518.

Free lab/shepherd mix, 6 blk w/whit, 1 gray w/whit. 332-2453.

Stud service, orange Sable Pomeranian, AKC-registered. x37990 or x33185.

**Household**

King sz waterbed w/new heating system, \$175. 534-4607.

Fern green velvet, steelcase tuxedo sofa, ex cond. 486-9700.

Solid pine queen sz waterbed, w/mirrored hdbd wshelves, 6 drws below, fits queen sz matt, \$200 OBO. 283-9357 or 474-3408.

New GE self cleaning elec range. Eric, x31917.

King sz bed, Stearns and Foster, extra firm, 5/mo, \$390. x35772 or 286-5821.

New couch, love seat, 2 yrs old, burg, \$375. 938-7157.

Queen sz oak waterbed, motionless matt, 12 drwr ped, bookcase hdbd, rails, htr, silk sheets, matt pad, \$300. 991-6503.

Butcher block style kitchen tbl, 4 padded chairs, two leaves, \$50. Beth, 283-8131.

**Photographic**

Canon AE-1 program w/FD 50mm 1:1.8 lens, 1:3.9 80 200mm lens, flash, carrying case, \$250. David, 282-3827 or 554-5514.

Olympus auto-zoom lens 35-105 mm, f/3.5 to 4.5, \$250; Vivitar Zoom Thyristor flash 3500, ex cond, \$80. 282-2894 or 486-2048.

Pentax X1000 35mm camera with a 50mm and 200mm lens, good cond, \$175 firm. 482-7627.

**Wanted**

Want roommate to share 3-2-2 house in Bay Glen, non-smoker, no pets, \$360/mo, plus 1/2 util and \$175 deposit. x30147 or 286-2011.

Want for demo only, not to buy, working DEC Rainbow computer w/2S/4D DD, color moni, ptr, hannes, 283-9364.

Want female, non-smoking roommate to share house in CL, all furnished except BR, \$250/mo plus 1/3 utilities, avail 11/1. Diana, x31512 or 286-9822.

Want housemate for 3-2-2 house in LC, \$300/mo plus 1/2 utilities. 334-3985.

**Miscellaneous**

G.E. SuperThirst A/C, new, still in box, 7,900 Btu, 5/8 ton, 115 volt, \$425 OBO. Julia, x30294.

Hein Gericke, sz 36, womens leather motorcycle jacket, ex cond, \$200 OBO. 474-3408.

Jeep CJ backseat, brwn, ex cond, \$95; above ground swimming pool ladder, \$20; deluxe DP weight bench, was \$85, now \$35. 280-7461 or 333-8130.

Tour Model III 1-SW golf clubs, \$16.95/club; metal woods, 1, 3, or 5, \$30/club. David, 554-5514.

State 10 gal midget elec water htr, ex cond, \$50; upright hood type hair dryer, good cond, \$15. 335-2472.

Shoei RF-108V motorcycle helmet, sm,

\$150 BO. 474-3408.

Going out of business, selling off inventory, Mary Kay cosmetics, ex selection, 40 to 50 percent off. 487-3718.

Estate sale, medium size ladies fur coats, jackets, pullovers, ski suit, fur hat, rain hat, sweaters, jerseys. 326-2221.

President and First Lady gold charter membership. \$500 OBO. 332-2388.

"Hornet" R/C car, assembled, 30 mph, 7.2 V batt, AC/DC recharger, transmitter, ex cond, spare parts, maintenance manual, ex cond, \$175 OBO. 488-5522.

Schwinn Air-Dyne exercise bike, less than 500 mi, ex cond, \$499. Mark, x30131 or 488-0056.

2 P205/75R15 tires on 15x6 Ford wheels, \$25; 2 15x5.5 Ford wheels, \$15; 2 14x5.5 Chrysler wheels, \$15; 10 1/4" inside diameter Ford hubcaps, \$15. 333-2830.

Full back Cab window, tinted, from '86 GMC truck. \$50 OBO. Jeanne, x37472.

'75 factory Ford truck shop manual, '77 factory Ford car shop manual, ex cond, \$25/ea. 538-1221.

Text books, for UH Central engineering class, ELEE 6370/5440 Adv Digital Design, ex cond. Youm, 283-4813.

Ladies suits, szs 6 and 8, \$20/ea. Lisa, 474-5609.

Front end nose cover for '89-92 Ford T-Bird, blk w/red T-Bird emblem, \$75 OBO. Jeff, 280-5159.

Rolex watch, presidents diamond Bezel face, ex cond, papers; 2 Leather sided glass top coffee tbl, \$50/ea; 2 15" wire wheel covers, \$25/ea. James, 335-6710 or 482-6744.

Miniature bottled water machine, \$100 OBO; Everex 80286 machine, \$1K; pre-schooler child learning system, \$350 OBO; baseball card factory sets, \$30/ea. Tony, 335-4299 or 482-4156.

Plywood skateboard ramp, RAD FUN, 4' Half Pipe, \$50 OBO. 554-2320.

Camper shell w/boat rack, fits '85 Toyota longbed PU truck, \$175. 486-9391.

Moving boxes, assorted szs, popcorn, \$20. Tim, x36324.

2 tickets to "A Tuna Christmas" at Cullen theatre for Friday, 10/25/91, \$30.50/ea; gas logs, used 2 mo, use on natural gas, not propane, \$100; auto cutoff pilot for propane, \$25. 488-5509.

Colt AR-15/w M-16 receiver, Sporter H-Bar, 3x-9x rubber armoured scope, ex cond, \$830; carrying case, 7 magazines, 200 rounds, \$60; Springfield Armory, 1911-A1 45 ACP w/2 magazines w/soft case plus 50 rounds, ex cond, \$380; Mossberg 590T 12 ga military shotgun, Parkerized, holds 9 rounds w/soft-case, ex cond, \$270. 283-1226 or 286-7828.

# New escape suit

## Advanced crew escape suit offers comfort, flexibility

By Pam Alloway

An updated launch/entry suit now under development may not look different from its original counterpart but test subjects claim it feels different.

An Advanced Crew Escape Suit, under development by NASA and the U.S. Air Force, already has received rave reviews from some of the men and women who would wear them during their climb into and descent from space.

"There's strong support for the new suit and to get it as soon as possible," said Astronaut Pierre Thuot. "It's definitely an improvement over the older suit in terms of comfort, heat load and mobility."

Thuot and fellow Astronaut Bill Shepherd are two of several astronauts who have been involved in the Advanced Crew Escape Suit's recent development and evaluation.

They have worked with Bruce Sauser, JSC's subsystem manager for crew escape equipment, who has headed up NASA's efforts to develop a new suit and also is pleased with the results.

"We've just completed all of our testing on the suit and right now everyone is gathering up all the final reports on the testing," Sauser said. "Once we get all those reports, we'll put together our certification report and that will be presented to the NASA community."

The bright orange launch/entry suit, manufactured by the David Clark Co., was part of the Return to Flight effort. The suit first flew on STS-26 in September 1988. The launch/entry suit consists of a helmet, and a counter-pressure suit and an anti-exposure suit integrated into one unit. The suit is designed to provide the necessary protection to sustain a crew member at or below 100,000 feet altitude for a 30 minute period.

Sauser said the advanced suit, once

approved by NASA management, would provide several improvements over the original launch/entry suit. Specifically, it would be lighter, cooler, more comfortable and allow more flexibility, he said.

The advanced suit is made up of one layer - nylon material laminated to both sides of a Teflon membrane called Gortex. The launch/entry suit uses a small amount of Gortex and two layers of nylon material that is coated with polyurethane which comprises the suit's "bladder" and presses against the crew member upon inflation. The combination reduces the suit's flexibility and can make its wearer warm. Both suits have flame retardant cover layers made of Nomex.

Making the suit more comfortable prompted the U.S. Air Force to embark on a research program of its own.

The U.S. Air Force also uses a full pressure suit in some of its high-altitude reconnaissance aircraft and, after the NASA suit was nearly developed, the Air Force began looking at ways in which to improve its suits which are similar to NASA's.

During the investigation, David Clark Co. researchers who were working for the Air Force discovered that Gortex material could be sealed off and made "non-breathable" by applying air pressure. Gortex had not been used for a suit's pressure bladder because it



Photo by Jack Jacob

"breathes" allowing water and air vapor to pass through it. But suit researchers discovered that applied air pressure could seal off Gortex material's pores making the material leak proof and enabling it to be used as the bladder material.

"We had kept abreast of what the Air Force was doing with this Gortex material as a pressure bladder and in 1990 we were granted a small amount of funding to jump in with the Air Force and do joint certification testing using Gortex material as a pressure bladder," Sauser said.

Although the changes in appearance are subtle, the operational changes are significant, Sauser said.

The most dramatic change between the two suits is that the advanced suit would be a full pressure suit versus the launch/entry suit which is partial pressure. The launch/entry suit uses mechanical pressure to protect the wearer from low cabin pressure which means that when the suit is inflated, the bladder material constricts around the wearer's arms and legs which can be uncomfortable, hot and reduce flexibility.

The advanced suit uses only air pressure with its one layer so it is cooler and loose fitting, which means it is more comfortable, Sauser said.

The advanced suit also has a detachable anti-gravity suit which is called a G-suit. The current launch/entry suit consists of a counter-pressure suit and a G-suit which are integrated into one unit. Crew members only use the G-suit during reentry so with the current configuration they are wearing the G-suit during ascent when it is really not needed. The advanced suit would allow crew members to wear the G-suit exclusively for reentry when it is needed.

During spaceflight, body fluid shifts upward toward a crew member's torso. The G-suit slows the movement of body fluid from the upper portion of the body to the lower extremities when crew members reenter Earth's one-gravity environment. This allows the human body to readjust more slowly to the Earth's atmosphere rather than subjecting the body to the sudden shock of gravity.

The advanced suit also has a wrist disconnect mechanism with specially designated gloves which will provide a tight seal. The current launch/entry suit gloves are connected to the suit's sleeves by a small valve and tube on the top side of each glove. The new feature of a wrist disconnect at both wrists is probably the most visible change between the current suit and the advanced suit.

Sauser said he and other JSC researchers working on this project hope that by Jan. 1 the certification report that they're now working on will be ready for program approval and that the suit will be certified for flight.

The current plan is to replace the launch/entry suits as they reach their designed usage limit with the advanced suits. The launch/entry suits were designed to last six-and-one-half years.

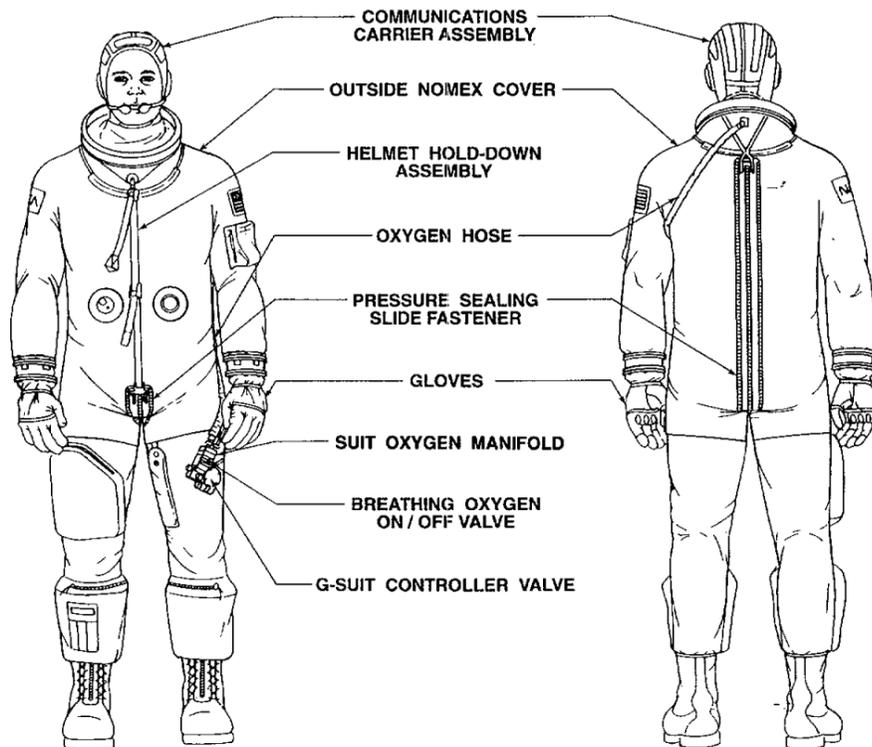
"The current suits start reaching their age life in 1994," Sauser said. "So probably in 1993, we'll look at putting together a procurement package for the new suits from the David Clark Co."

*It's definitely an improvement over the older suit in terms of comfort, heat load and mobility.*

— Astronaut Pierre Thuot



### Crew Escape Equipment



Top: Peggy Halford, a Lockheed quality requirements analyst, and Bruce Sauser, JSC crew escape equipment subsystem manager, look over an advanced crew escape suit in the Bldg. 7 Crew Escape Development Laboratory. The new suit features a wrist disconnect which the current launch/entry suit does not. Sauser is holding a launch/entry suit glove in his right hand while comparing it to the advanced suit's wrist disconnect glove shown here in his left hand.

Left: This illustration shows the various components of the advanced crew escape suit. The advanced suit would use the same helmet currently used in the Space Shuttle program. The advanced suit also has a detachable anti-gravity suit (also called a G-suit), another feature the launch/entry suit does not have.

Right: STS-38 Commander Richard Covey is shown in a launch/entry suit that is a partial pressure suit and is comprised of two layers. The advanced suit is a full pressure suit which would provide comfort, coolness and improved flexibility. It is comprised of one layer.

NASA Illustration

NASA Photo





Astronaut Tammy Jernigan recently tested some Soviet space welding equipment on a KC-135 flight. The equipment, which was used on several Soviet spacewalks, was loaned to the United States as part of a joint evaluation by JSC and McDonnell-Douglas. The successful test provided information to researchers regarding human factors interfaces for repairing large space structures.

NASA Photo

## Moon soil could provide resources for lunar base

(Continued from Page 1)

on the Moon, it will be a significant savings in long-term operating costs for the Lunar base," said Dr. David McKay, chief of Mission Science and Technology for the Solar System Exploration Division.

Factors considered by scientists in evaluating the processes that could produce oxygen for Lunar base use include the simplicity of the overall process, the amount of resupply materials needed, the energy requirements and size of the processing plant, and the various feedstocks readily available.

The oxygen production process

Taylor favors is called ilmenite reduction. Ilmenite, a compound composed of iron, titanium and oxygen, occurs abundantly in the Lunar soils, breccias, rocks and basalts.

Synthetic ilmenite feedstock was heated to 1018 degrees C and gaseous hydrogen was passed over the material. As the hydrogen passed over the heated sample, the hydrogen chemically reduced the material, releasing oxygen which combined with the hydrogen and condensed into water in the collection dish.

The hydrogen was then pumped back through the system and passed

through drierite crystals to remove the last bit of water before it circulated back across the heated sample bed.

Although a total of 20 processes have been evaluated, many have not been tested because of their extreme complexity and the difficulty of implementing them. A ranking of the processes according to their overall feasibility resulted in eight processes being considered the most likely candidates for further testing.

"At this early stage, all the processes should be evaluated," Taylor said. "We don't know enough yet to decide on any one process."

## Mini-rover passes Death Valley test

Scientists and engineers at NASA's Jet Propulsion Laboratory, investigating low cost approaches to exploring Mars, successfully tested a small robotic vehicle in rough terrain nearly identical to the two Viking landing sites on Mars.

The test of the mini-rover "Rocky III" in the Avawatz Mountains south of Death Valley demonstrated one of several proposed approaches to future Mars exploration.

Mini-rovers and the even smaller micro-rovers provide NASA planners with a new class of low-cost planetary exploration options, said Roger Bedard, Manager of Rover Technologies at JPL.

Micro-rovers are defined as robotic vehicles under 11 pounds in weight. Mini-rovers are larger, up to about 52 pounds, the weight of Rocky III.

The rovers will carry cameras for close-up looks at the surface and to scan the horizon of Mars. In addition,

they will carry micro-machined sensors to test the atmosphere and soil, spectrometers to gather geologic information and seismometers to capture data on crustal motion.

Dr. Matthew Golombek, principal science advisor on the project, said the terrain used in the test has the rock size and distribution of the Viking 2 site on Mars and features large boulders strewn across a gravelled surface. Rocky III successfully traversed the rough terrain in two tests, he said. It also was successful in traversing a lava field in the Mojave Desert.

"It was at least a starting point," Golombek said. "We are certain there are basalt (lava) flows on Mars. We are testing this rover for an unmanned sample-return mission."

Don Bickler, an engineer and one of the designers of the rover, said the group wanted also to "test the rover's configuration, the suspension geometry, the ratios of levers and the wheel

diameters."

"We wanted to see if it would confirm the tests we made in the laboratory, to see if in the natural environment this thing would perform as the lab tests said it would. And it did," Bickler said.

The next generation of micro- and mini-rovers, now being designed, will include microsensors to help the machine measure some qualities of its environment. Because of their small size and low weight, micro- and mini-rovers would be relatively inexpensive to launch to the moon or Mars, Bedard said.

"A new era of space exploration is made possible by advances in miniaturization technology and in distributed communications," said Dr. Giulio Varsi, manager of JPL's Space Automation and Robotics Program. "I believe these advances will make possible less expensive missions and broader participation of people."

## New Langley director named

NASA Administrator Richard H. Truly this week appointed Paul H. Holloway as director of the Langley Research Center.

Holloway, who has been deputy director at Langley since February 1985, succeeds Richard H. Petersen who was recently appointed the associate administrator for the Office of Aeronautics and Space Technology at NASA Headquarters.

Holloway began his career at Langley in 1960 as an aerospace research engineer. He was appointed head of the Systems Analysis Section, Aero-Physics Division, in 1969 and head of the Aerospace Operations Analysis Branch, Space Systems Division 1971. He was chief of the Space Systems Division from 1972 until he became director for space in May 1975, a position

he held until being named deputy center director in 1985.

"We in NASA are very fortunate to have leaders with the professional reputation and experience of Paul Holloway to fill our most senior positions," Truly said in making the announcement. "The Langley Research Center, as NASA's longest standing field organization, vividly represents the research and exploration heritage of the entire agency, and Paul Holloway is the ideal person to be at its helm."

Holloway is the recipient of several awards including the Senior Executive Service's Distinguished Presidential Rank Award in 1987, the Presidential Rank of Meritorious Service in 1981 and the NASA Outstanding Leadership Medal in 1980.

## Augustine to receive National Space Trophy

The Rotary National Award for Space Achievement Foundation this week announced the selection of Norman R. Augustine as the recipient of the 1992 National Space Trophy.

Augustine, chairman and chief operating officer of the Martin Marietta Corp., will receive the award for his outstanding leadership in shaping the future direction of the U.S. space program.

The award, which was presented to JSC Director Aaron Cohen this year, recognizes Augustine's 33-year career as "a guiding force in our nation's exploration of space," according to the award announcement.

Augustine served as chairman of the presidential advisory committee on "The Future of the U.S. Space Program." He was appointed to the 12-member panel by Vice President Dan Quayle in August 1990. The committee was given the task of reviewing current and future space initiatives.

The four-month study of the civilian space program resulted in far-

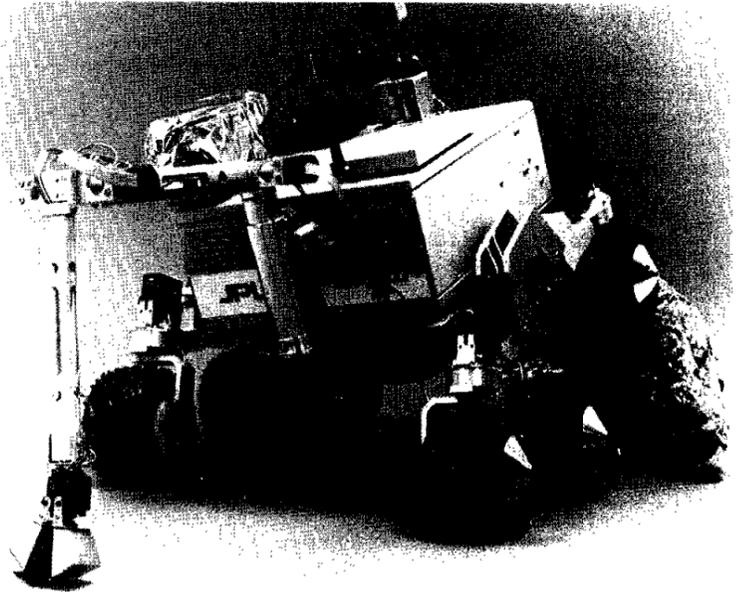
reaching recommendations for the restructuring of NASA and the future direction of the space program.

Augustine joined the Douglas Aircraft Company in 1958 as a program manager and chief engineer. He then served at the Pentagon in the Office of the Secretary of Defense as an assistant director of Defense Research and Engineering. He later joined the LTV Missiles and Space Company as vice president.

In 1973, he became Assistant Secretary of the Army and in 1975 Under Secretary of the Army. He joined Martin Marietta in 1977.

Augustine is the sixth individual to receive the Space Trophy. Besides Cohen, previous winners were spacecraft designer Maxime Faget, 1987; former Congressman Donald Fuqua, 1988; NASA Administrator Richard Truly, 1989; and former director of the Jet Propulsion Laboratory Lew Allen, 1990.

Augustine will receive the award at special banquet Feb. 13, 1992.



JSC Photo

Rocky III, Jet Propulsion Laboratory's latest Mars Rover, recently was tested in the rocky terrain of Death Valley.

## Space News Roundup

The Roundup is an official publication of the National Aeronautics and Space Administration, Lyndon B. Johnson Space Center, Houston, Texas, and is published every Friday by the Public Affairs Office for all space center employees.

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Editor ..... Kelly Humphries  
Associate Editors ..... Pam Alloway  
Kari Fluegel

## Total Quality Management starts with employees

(Continued from Page 1)

"This carries with it the idea of empowering the working level people," said Robbins, who heads the subcommittee on the training process. "Who, after all, produces the product here at JSC? It's not us over here in Bldg. 1. It's the people in the branches and the sections who put out the work."

But why something like TQM, and why the space program? The answer comes from the JSC community itself. Ninety-six percent of the respondents in a survey earlier this year said that improving quality is an increasingly important issue for the U.S. space team, and 77 percent of them said that an increase in the quality of JSC's processes, products and services by a factor of 10 is achievable by 1995.

"Typically," Nebrig said, "those companies who have adopted this approach to quality management in the past have been the ones who have seen their market share slip and their profits decline. Although we are a government entity, we are in the same situation. We are faced with a number of major challenges and issues in the space program, and the best response to that is an aggressive effort to change — and improve — our way of doing business, from top to bottom, throughout the organization."

Central to the philosophy of those who have been involved in the TQM process over the past few years is the realization that the litany must stop or the future of U.S. space exploration is threatened. The litany? Every JSC employee knows it, and has heard it relentlessly since the dark days fol-

lowing the *Challenger* accident: the shuttle is unreliable and too expensive, space flight is risky and failures may spell political peril, hydrogen leaks, flawed optics, stuck antennas.

It's a long list, and the effort to effect change has been a long one as well. Since the early 1980s, JSC has moved steadily toward the changes embodied in TQM. From the Productivity Improvement and Quality Enhancement program to the NASA Employee Teams formed after 51-L, the Center moved toward the adoption of a new strategic plan in 1987, and in 1990 won the Office of Management and Budget's Prototype Award for improved performance.

"The only problem with all of that," Nebrig said, "is that it didn't go deep enough."

Through a five-day process of

specialized training, Q+ team members will learn to be advocates for improvement with techniques such as the five problem-solving steps: defining the problem, collecting data, analyzing the problem, developing solutions and implementing improvements.

The teams are being structured along organizational lines, with membership consisting of a diagonal slice across the organization, involving multiple levels. Leaders will be selected by the team members, in partnership with coordinators chosen by management. Team membership will typically be reconstituted after one or two years.

"It's our future," Nebrig said, "and how we get there, and what we do there, is, in the final analysis, really up to all of us."